CHAPTER V

CONCLUSIONS, DISCUSSION, EDUCATIONAL IMPLICATIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The analysis and interpretations done in the earlier section lead us to the following conclusions:

5.1.1 Conclusions Related to Cognitive Achievement

The comparison of the groups at various levels of cognitive achievement under investigation in the present study lead to the following results:

5.1.1.1 The students following the mastery learning strategy gained higher in their cognitive achievement ($\alpha = 0.01, d.f. = 48$) as compared to the traditionally taught reference group students, thereby accepting hypothesis H1.

5.1.1.2 The group of students taught physics by mastery learning strategy gained higher in their knowledge cognition ($\alpha = 0.01, d.f. = 48$) as compared to the control group students taught by the traditional method of instruction, thereby accepting hypothesis H1-1.

5.1.1.3 The group of students taught physics by mastery learning strategy gained higher in their comprehension cognition ($\alpha = 0.01, d.f. = 40$)
as compared to the reference group students
who were taught by the traditional method, thus
accepting hypothesis H1=2.

5.1.1.4 The students of the treatment group taught by
mastery learning strategy gained higher in
their application cognition ($\alpha=.01, d.f.=48$)
in contrast to the traditionally taught reference
group, thereby accepting hypothesis H1=3.

5.1.1.5 The students with low cognitive entry behaviour
did not gain significantly ($\alpha=N.S., d.f.=10$) by
the treatment of mastery learning strategy as
compared to their counterparts in the control
taught by the traditional method, thus rejecting
hypothesis H1=4.

5.1.1.6 The average cognitive entry behaviour students
of the experimental group taught by mastery
learning technique gained significantly higher
in achievement ($\alpha=.01, d.f.=10$) as compared to
their traditionally instructed counterparts in
the control group, thereby accepting hypothesis
H1=5.

5.1.1.7 The high cognitive entry behaviour students of
the treatment group following mastery learning
strategy gained significantly higher in their achievement ($\alpha=.05,d.f.=10$) as compared to their counterparts in the control group, thereby accepting hypothesis HII-6.

5.1.2 Conclusions Related to Scientific Attitude:

The comparison of the various aspects of scientific attitude of the two groups after the experiment leads to the following findings:

5.1.2.1 The students taught physics by mastery learning strategy gained significantly higher in their scientific attitude ($\alpha=.01,d.f.=48$) as compared to the students of the reference group, thereby accepting hypothesis HII.

5.1.2.2 The students of the experimental group undergoing mastery learning treatment gained significantly higher in their attitude toward scientific method ($\alpha=.01,d.f.=48$) as compared to the traditionally instructed control group students, thereby accepting hypothesis HII-1.

5.1.2.3 The students undergoing the treatment of mastery learning technique gained significantly higher in the attitude toward scientific temper ($\alpha=.01,d.f.=48$) as compared to the traditionally
taught control group students, thereby accepting hypothesis H1=2.

5.1.2.4 The students of the experimental group following mastery learning strategy gained significantly higher ($< .01, d.f. = 48$) in their attitude toward implications of science as compared to the control group students taught by the traditional method of instruction, thereby accepting hypothesis H1=3.

5.1.2.5 The students of the experimental group with low cognitive entry behaviour gained significantly higher in scientific attitude ($< .01, d.f. = 10$) due to mastery learning treatment as compared to their traditionally taught counterparts in the control group, thereby accepting hypothesis H1=4.

5.1.2.6 The students of the experimental group with average cognitive entry behaviour gained significantly higher in their scientific attitude ($< .05, d.f. = 10$) as compared to their counterparts in the control group, thereby accepting hypothesis H1=5.

5.1.2.6 The students of the experimental group with high cognitive entry behaviour did not change
scientific attitude due to the treatment of mastery learning strategy, thereby rejecting hypothesis H II-4.

5.2.3 Conclusions Related to Students' Reactions to Mastery Learning Strategy

5.2.3.1 The group of students taught physics by mastery learning strategy had extremely favourable reactions toward the method of instructions of his has been revealed by the scores on the course evaluation questionnaire which has a range from 73 to 91 with the mean score of 80.94, but of a total of 100 scores. Thus, hypothesis H III was accepted.

The reactions of the students on all the three parts of mastery learning strategy, namely evaluation of study units and mastery tests, evaluation of tutors, and evaluation of course in general have been extremely favourable with mean percentage scores as 84.5 and 86.6, respectively, thereby accepting hypothesis H III.
5.2 DISCUSSION

The results as interpreted in the earlier section, reveal the superiority of mastery learning technique of classroom instruction over the lecture model. It has been observed that mastery learning strategy improved significantly the achievement in physics and scientific attitude of the group of students following this approach in teaching physics. The implications of the results obtained are discussed below, taking first the cognitive achievement and later the scientific attitude.

The mastery learning had a positive effect on cognitive achievement and this could be attributed to the built-in features of the strategy, making it a better method of instruction as compared to the lecture method. These built-in features of mastery learning strategy and their influence on achievement could be explained as follows:

1. **Sequencing and structuring of subject matter:**

In mastery learning strategy, the subject matter was structured into small study units. The students were required to assimilate each unit separately. The interaction of the students with small learning segment at a time made it easier for them to learn it thoroughly.

Also in mastery learning situation, the subject
matter is sequenced in an inter-related manner and is very appropriate. Generally, the learners build up their learning step by step as some learning tasks are fundamental for further learning. It seems more appropriate to master certain simple learning tasks first before proceeding onto more complex tasks.

Incorporation of the feature of proper structuring and sequencing of subject matter in mastery learning strategy, to which the students of the experimental group were exposed, would have contributed toward better cognition achievement.

(ii) Self-pacing:

In mastery learning strategy, students were permitted to learn at rates suitable to their capabilities. The slow learners were given more time to consolidate their learning. It is quite understandable that if the degree of learning is fixed at some mastery level then the time to reach that level will vary from student to student.

Due to the provision of self-pacing in mastery learning strategy, the students found adequacy and autonomy in their learning in the present study, thereby improving their academic performance.
(iii) Mastery-testing and self-testing:

In the present study, the testing procedures in mastery learning strategy is different than that followed in the conventional method of teaching. In fact, mastery learning strategy, follows the criterion-referenced testing in which the student allowed to move on to the next study unit, if he passed his on-going unit with the marks more than the criterion fixed for successful performance (80% marks in the unit test in the present study). Moreover, unsuccessful performance in the mastering test was not taken against the student but he is given corrective feedback followed by a re-testing session.

Also in mastery learning strategy, each study unit was followed by a set of self-testing exercises. These exercises enabled the student to chart his own progress toward the criterion standard fixed for successful performance.

It seems that these kinds of testing procedures proved helpful in striving for and maintaining a high level of achievement by the students following mastery learning strategy.

Furthermore, the better academic performance by the students of the treatment group can be explained in
terms of the fact that mastery learning strategy produced better retention of the subject matter. As consolidation of the on-going study unit is a pre-requisite for the student’s achievement to the next unit as controlled by the mastery test.

Thus, the provision of fixing a criterion for entry to the next study unit and emphasis on consolidation of the subject matter of the present study unit could have been responsible for better performance by the students of the treatment group.

(iv) **Behavioural Objectives**

In mastery learning strategy, the competencies to be mastered by students were expressed in terms of explicit statements which describe the cognitive behaviours expected from them after the instruction. Thus, the behavioural objectives setforth for each study unit work as guides for learning along with setting a purpose for learning. Also, students felt a sense of security as they knew what is expected from them specifically in the course of study.

Because of the statement of behaviour objectives, the intended purpose of instruction became clear to the students of the experimental group and it resulted in better performance by them in the present study.
(v) **Corrective and remedial feedback**

In mastery learning strategy, the student were encouraged to take individual guidance from the fast learners and the instructor during his learning of the study unit. Moreover, after every mastery testing session, the student was given a corrective feedback followed by a re-testing session if the criterion for successful performances in the study unit was not met by him.

Thus, with the individual guidance and evaluation being taken as integral part of the learning process in mastery learning strategy, it would have resulted in better cognitive achievement, by the students of the experimental group in the present study.

Furthermore, in the present study an enquiry was made to find out that which level of cognitive domain was most influenced by mastery learning strategy. For this purpose, the following three levels of cognitive domain, which are relevant to the school students, were taken for investigation:

(a) **Knowledge cognitive**;

(b) **Comprehension cognitive**; and

(c) **Application cognitive**.

The present study has revealed that all the three
levels of cognitive domain showed significant improvement due to mastery learning treatment.

The significant improvement in all three levels of cognition due to the treatment could be due to the self-testing exercises and frequent mastery testing sessions which gave students enough practice to answer rightly the test items pertaining to different levels of cognitive domain. Self-testing and mastery testing are the features of mastery learning strategy as described earlier.


Next, it was found that the group of students exposed to mastery learning strategy gained significantly higher in their scientific attitude as compared to the students taught by the conventional method.

Also, an investigation was made to establish which element of the scientific attitude was affected more by mastery learning strategy. For this purpose, the scientific attitude scale was split into three parts to cover the
following three elements:

(i) Attitude toward scientific method;
(ii) Attitude toward scientific temper; and
(iii) Attitude toward implications of science.

It has been found that mastery learning strategy improved all the three elements of scientific attitude.

The positive effect of mastery learning strategy on scientific attitude could be attributed to frequent interactions of students with the instructor and the peer.

The in-built mechanisms of mastery learning strategy allow students to seek individual guidance from the instructor and fast-learners (peer-tutors) at any stage of the instruction, thereby influencing the attitudes of the students of the treatment group.

This result is supported by the findings of the study conducted by Cloward (1967).

Further, to determine whether all students, i.e., students with varying levels of entry behaviour achievement benefit equally from the mastery learning technique, three subgroups of students were formed consisting of six top rankers (i.e., top 24% students), six bottom rankers and six middle rankers randomly chosen from thirteen left over
students. These groups were formed on the basis of rank orders of the students in the cognitive entry behaviour test scores, i.e., pre-experimental test scores.

A : Six bottom rankers : Low cognitive entry behaviour group.

B : Six middle rankers : Average cognitive entry behaviour group.

C : Six top rankers : High cognitive entry behaviour group.

In respect of the effect of mastery learning strategy on intra-group cognitive achievement, the following findings emerged:

(a) Mastery learning strategy was not useful in improving the achievement of the students of low cognitive entry behaviour.

(b) Mastery learning strategy improved the achievement of the students of average cognitive entry behaviour.

(c) Mastery learning strategy improved the achievement of the students of high cognitive entry behaviour.

The reason for the weak students not improving their cognitive achievement due to the treatment of mastery
learning strategy could be because of the high criterion level in the present study for deciding the students' entry to the next study unit. The criterion level in the present study was 80% marks in the mastery test. This high criterion level could be unrealistic for the weak students and probably produced anxiety due to a large number of re-tests taken by such students to reach the criterion level of eighty percent marks. The weak students due to their low-pace could not cover all the units for which the post-treatment achievement test was administered, thereby not improving their achievement.

In respect of a significant improvement in the cognitive achievement of the students of high cognitive entry behaviour, it can be argued that in mastery learning technique such students strive to main a high pace of learning and achievement level to acquire the leadership to work as peer-tutors.

The highest improvement in cognitive achievement amongst the three groups has been shown by the average students due to mastery learning strategy. It seems that the average students received the maximum benefit of the built-in features of mastery learning strategy describe in the earlier part of this chapter.

These results find support in the findings of the

With regard to the effect of mastery learning strategy on the changes in the scientific attitude of the three subgroups of the students, the following conclusions were drawn:

(a) Mastery learning strategy was helpful in improving the scientific attitude of the low cognitive entry behaviour group of students.

(b) Mastery learning strategy was also helpful in improving the scientific attitude of the average cognitive entry behaviour group of students.

(c) Mastery learning strategy was not helpful in improving the scientific attitude of the high cognitive entry behaviour group of students.

The improvement in the scientific attitude of the academically weak and average students due to mastery learning strategy can be explained by the fact that such students got ample opportunities to interact most frequently with the peer-tutors (bright students) and the instructor.
These interactions were frequent as the entry to the next study unit was controlled by a high criterion level and this resulted in positive attitudinal changes of low and average cognitive entry behaviour students.

The scientific attitude of the students with high cognitive entry behaviour not being affected by mastery learning strategy can be explained by the fact that such students already had high attitudes as per Best's (1978) criterion of intensity of attitudes. Thus, there existed a very less scope for further improvement. The students with high cognitive entry behaviour generally have positive but rigid attitude.

These results correspond to the survey of findings done by Ediger (1983) and findings of Ramachandara (1981).

Lastly, the reactions of the students towards mastery learning strategy were collected after the treatment of the six weeks. There were extremely favourable reactions of the students toward mastery learning strategy as the mean score on the group at five point scale of the questionnaire was above the average scale value.
The favourable reactions of the students of the treatment group toward the strategy could be due to the reason that most students found it comfortable to learn at their own paces resulting in an adequacy in their learning. Also, the presentation of the course material in small study units, peer-tutoring, corrective feedback and individual guidance from the instructor facilitates the students' learning leading to favourable reactions towards the strategy.

This result finds support in the evidences reported by Fennell E-Luekann (1979), Mallada (1982), Mathur (1982), Mooe (1984) and Yadav (1984).

Thus from the findings of the present study it can be concluded that mastery learning strategy produces positive cognitive and affective changes among students. Thus, mastery learning strategy can work as a viable alternative to the lecture model of instruction.
5.3 EDUCATIONAL IMPLICATIONS:

On the basis of the conclusions of the present study, that mastery learning strategy is helpful in increasing the achievement and attitude of students. The strategy can very well work as a viable and refreshing change from the traditional method of teaching. Undoubtedly, improving students' academic performance in the main focus of all the educators, parents and administrators, as there is a lot of emphasis in the achievement score and certification in our country.

Furthermore, mastery learning strategy does not need any new technology and extra-expenditure for the implementation. Using most of the available resources only, mastery learning strategy can be easily implemented for classroom instruction. Also, the teacher competencies required for planning and implementation of mastery learning strategy are simple and most teachers can acquire those with a little effort.

It is also important that a reconsideration of general education under the New Education Policy (1985) of the Government of India to be implemented from the academic session 1986-87 must take into account the present day knowledge explosion. The mass of knowledge that forms a part of a modern man's intellectual heritage is expanding exponentially. In this context the role of teaching can no longer be transmitting the large blocks of knowledge as such. The role should be that of providing the student with the intellectual tools of gaining the already recorded
and producing new knowledge. This can very well be achieved by self-paced personalised instruction based on self-study and mastery learning.

In this age of knowledge explosion, it is fundamental that the students' learning be independent or at the most be guided. There is no doubt that mastery learning strategy can foot the bill in this respect as it allows a higher degree of student initiative in the learning process. However, even in mastery learning strategy situation, a careful teacher guidance is essential.

Moreover, mastery learning strategy frees the teacher for some more creative aspect of classroom instruction such as remediation, correction and guidance on individual basis or in small groups. Thus, a good self-paced learning system like mastery learning strategy is certainly better to poor teachers and bad conditions for handling masses of students. This is because of the fact that mastery learning strategy is helpful in developing students' abilities to learn on their own. Also, mastery learning strategy does not encourage the unhealthy competition and anxiety as the case in the traditional teaching method which lays emphasis on the end-of-term examination for the students' promotion to the next class. The positive effect of the mastery learning
strategy on the achievement score of students suggests that the differences in learning rates can be accommodated through the provision of additional time for those who need it.

Mastery learning approach, being a self-paced instructional procedure, forces the teacher to define the learning objectives precisely according to the prescribed performance criteria. Thus, basically, mastery learning approach is product-oriented in character. Moreover, efficiency in education is considered to be synonymous with productivity in the present world of technology, which is measured in terms of cost, achievement, facilities and retention and desired attitudes. As mastery learning strategy uses the printed material and produces better cognitive and affective consequences at the same cost as the lecture model of instruction, this approach may be used for planning and implementing for instructional improvement in our country as a deviation from the lecture model of instruction.

In a developing country like India, much can be achieved with existing resources if efforts are made to produce instructional materials based on mastery learning strategy. Research in this area in the Indian context justifies that mastery learning strategy can work as a viable alternative to much maligned lecture model of instruction,
As the modern society needs continual learning throughout life, the schools can promote this idea effectively through the mastery learning strategy. It is because of the fact that mastery learning strategy encourages self-study habits by forcing students to interact with the printed material.

If the schools are to be organised for implementing the mastery learning strategy, many things about the school would have to change. In the new situation, grades would be meaningless because virtually all students would achieve mastery of the assigned learning blocks, only on different rates. Organising schools on time basis, i.e., academic year or semesters, would no longer make sense because some students would take longer to achieve mastery, while others would accomplish the tasks in much shorter span. While the concept of mastery learning is extremely logical much effort and spade work will be required before schools can operate on that basis in India.
5.4 **RECOMMENDATIONS FOR FURTHER WORK**

The present research study has assessed the contribution of mastery learning strategy toward achievement and scientific attitude of science on experimental basis in the residential school setting. It has been observed that the frequent testing, individual guidance, unit perfection requirement and specific objectives affect the said variables positively.

It would greatly enhance the generalizability of outcomes if other investigators compare the effects of mastery learning strategy across several courses and replicate findings across several academic sessions. There is enough scope for longitudinal studies spread over longer time in different subjects areas.

Also there are no accepted standards for what information a researcher in mastery learning strategy ought to represent. Consequently, it is difficult to reconstruct parameters of particular applications of behavioural instruction like mastery learning strategy from the published reports. There is a need for research for developing certain standard notational system covering all the parameters of mastery learning strategy. Such research would greatly facilitate researchers in the area of mastery learning by placing
the different variations of the strategy within an understandable context.

Moreover, an important aspect of learning, i.e., behaviour modification, has a deep concern for the individual and dissatisfaction with the group data studies should be designed to determine that what variables prevent every student from reaching the mastery level. The researches should be taken up on student characteristics X Learning Material Structure X Mastery Learning Components. The studies should be conducted to investigate the effect of change in criterion level, frequency of testing, frequency of remediation, intensity of individual guidance on cognitive gains under mastery learning strategy setting.

Further, there is a need for studies for comparing different variants of mastery learning strategy to specify a taxonomy relating the parametric values of various components of mastery learning strategy, like subject matter structure, student characteristics and dependent variables.

It also remains for further investigators to move beyond the stage of norm-referenced evaluation through a series of carefully designed studies on the effect of the criterion-referenced evaluation on different cognitive
and effective variables under group instruction and mastery learning situations.

It is further suggested the cross-cultural studies should be carried out in the rural and urban schools with mastery learning strategy setting. The studies should be undertaken to determine which additional personality traits could serve as significant predictors of performance in the courses taught using mastery learning strategy. Also, there is scope for conducting studies to investigate if various combinations of mastery learning strategy and other models of instruction could improve the applicability of knowledge thus gained.

Furthermore, studies should be conducted at all age and grade levels to determine that what level is most appropriate for mastery learning strategy implementation. Also the studies need to be conducted to determine the facilitative effects of mastery learning strategy on learning by students at all levels of cognitive domain and long term effects of the strategy.